

WHAT IS CLAIMED IS:

2. (Amended) A substrate attracting and holding method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relation, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

attracting and holding the substrate,

wherein the substrate is supported so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed above the protrusion.

3. (Amended) A substrate attracting and holding method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relation, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

attracting and holding the substrate,

wherein the substrate is supported so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed at a central portion in relation to disposition of the protrusion.

5. A substrate attracting and holding method, comprising the steps of:

C² supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relation, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

attracting and holding the substrate,

wherein the substrate is supported so that the protrusion is placed at the same position with reference to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

7. (Amended) A substrate attracting and holding method, comprising the steps of:

C³ supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relation, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

attracting and holding the substrate,

wherein at least a portion of the protrusion surrounds a zone corresponding to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

11. (Amended) A substrate attracting and holding method, comprising the steps of:

C4 supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relation, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

attracting and holding the substrate,

wherein at least a portion of the protrusion surrounds a zone corresponding to the position of the alignment mark of the position with respect to which the alignment mark is to be produced, and further comprising adjusting the pressure of air between the holding table and the substrate in a region as surrounded by the protrusion.

15. (Amended) A substrate attracting and holding system, comprising:

a holding table for holding a substrate; and

C5 a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed above the protrusion.

16. (Amended) A substrate attracting and holding system, comprising:

a holding table for holding a substrate; and

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a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed at a central portion in relation to disposition of the protrusion.

18. (Amended) A substrate attracting and holding system, comprising:

a holding table for holding a substrate; and

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a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced,

wherein the protrusion is provided so that the protrusion is placed at the same position with reference to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

19. A system according to Claim 14, wherein the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed outside a processing region of the substrate.

20. (Amended) A substrate attracting and holding system, comprising:

a holding table for holding a substrate; and

C⁹ a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced,

wherein at least a portion of the protrusion is disposed to surround a zone corresponding to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

25. (Amended) A substrate attracting and holding system, comprising:

a holding table for holding a substrate; and

C⁸ a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced,

wherein at least a portion of the protrusion is disposed to surround a zone corresponding to the position of the alignment mark or the position with respect to which the

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alignment mark is to be produced, and said system further comprises a pressure adjusting mechanism for adjusting pressure of air between said holding table and the substrate in a region as surrounded by the protrusion.

34. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein a disposition pitch L of the protrusions and an attraction force P of the substrate are set so as to satisfy a relation:

$$P \cdot L^3 \leq [36 \cdot E \cdot h^2 \cdot dx dy] / [\sqrt{3} \cdot k \cdot c]$$

where dx dy is a distortion tolerance, E is a longitudinal elasticity coefficient, h is a thickness of the substrate, c is a correction coefficient based on the protrusion disposition and k is a neutral plane coefficient.

35. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein a disposition pitch L of the protrusions and an attraction force P of the substrate are set so as to satisfy a relation:

$$P \cdot L^3 \leq 0.00427.$$

36. A system according to Claim 34 or 35, wherein the disposition pitch L and the substrate attraction force P are set to further satisfy relations:

$$G \cdot h \cdot \rho / \mu \leq P \leq 100000$$

$$0.0005 \leq L \leq 0.005,$$

wherein h is a thickness of the substrate, ρ is a density of the substrate, μ is a stationary friction coefficient of the substrate, and G is a maximum acceleration of a stage on which said substrate attracting and holding system is mounted.

37. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein a disposition pitch L of the protrusions and an attraction force P of the substrate are set so as to satisfy relations:

$$P \cdot L^3 \leq 0.00427$$

$$33 \leq P \leq 100000, \text{ and}$$

$$0.0005 \leq L \leq 0.005.$$

38. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein the protrusions include an outer peripheral protrusion for supporting an outer peripheral portion of the substrate and a central protrusion for supporting a central portion of the substrate, inside the peripheral portion thereof, and that, when a disposition pitch of the central protrusion is L_a and an attraction force of the substrate at the central protrusion is P_a while a disposition pitch between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion is L_b and

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an attraction force of the substrate between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion is P_b , the disposition pitches P_a and P_b are set so as to satisfy relations:

$$P_a \cdot L_a^3 \leq [36 \cdot E \cdot h^2 \cdot dx dy] / [\sqrt{3} \cdot k \cdot c]$$

$$P_b \cdot L_b^3 \leq [8 \cdot E \cdot h^2 \cdot dx dy] / [k \cdot c],$$

where $dx dy$ is a distortion tolerance, E is a longitudinal elasticity coefficient, h is a thickness of the substrate, c is a correction coefficient based on the protrusion disposition and k is a neutral plane correction coefficient.

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39. A substrate attracting and holding system comprising:

a plurality of protrusion for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein the protrusions include an outer peripheral protrusions for supporting an outer peripheral portion of the substrate and a central protrusion for supporting a central portion of the substrate, inside the peripheral portion thereof, and that, when a disposition pitch of the central protrusion is L_a and an attraction force of the substrate at the central protrusion is P_a while a disposition pitch between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion L_b and an attraction force of the substrate between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion is P_b , the disposition pitches L_a

and Lb and the attraction forces Pa and Pb are set so as to satisfy relations:

$$Pa \cdot La^3 \leq 0.00427; \text{ and}$$

$$Pb \cdot Lb^3 \leq 0.00164.$$

40. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein the protrusions include an outer peripheral protrusion for supporting an outer peripheral portion of the substrate and a central protrusion for supporting a central portion of the substrate, inside the peripheral portion thereof, and that, when a disposition pitch of the central protrusion is La and an attraction force of the substrate at the central protrusion is Pa while a disposition pitch between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion is Lb and an attraction force of the substrate between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion is Pb, the disposition pitches La and Lb and the attraction forces Pa and Pb are set so as to satisfy relations:

$$Pa \cdot La^3 \leq 0.00427$$

$$33 \leq Pa \leq 100000$$

$$0.0005 \leq La \leq 0.005$$

$$Pb \cdot Lb^3 \leq 0.00164$$

$$33 \leq Pb \leq 100000; \text{ and}$$

$$0.0005 \leq Lb \leq 0.005.$$

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41. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein the protrusions include an outer peripheral protrusion for supporting an outer peripheral portion of the substrate and a central protrusion for supporting a central portion of the substrate, inside the peripheral portion thereof, that a disposition pitch of the central protrusion is made larger than a disposition pitch between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion, and that an attraction force of the substrate at the central protrusion is made smaller than an attraction force of the substrate between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion.

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42. A substrate attracting and holding system comprising:

a plurality of protrusions for supporting a substrate, for attracting and holding the substrate supported on the protrusions, wherein the protrusions include an outer peripheral protrusion for supporting an outer peripheral portion of the substrate and a central protrusion for supporting a central portion of the substrate, inside the peripheral portion thereof, that a disposition pitch of the central protrusion is made not less than a disposition pitch between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion, and that an attraction force of the substrate at the central protrusion is made larger than an attraction force of the substrate between the outer peripheral protrusion and a central protrusion juxtaposed inside the outer peripheral protrusion.

53. An exposure apparatus, comprising:

a substrate attracting and holding system as recited in Claim 34; and

exposure means for transferring, by exposure, a pattern of an original onto a substrate as attracted and held by said substrate attracting and holding system.

54. A device manufacturing method, characterized by producing a device through

manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 53.

55. An exposure apparatus, comprising:

a substrate attracting and holding system as recited in Claim 35; and

exposure means for transferring, by exposure, a pattern of an original onto a substrate as attracted and held by said substrate attracting and holding system.

56. A device manufacturing method, characterized by producing a device through

manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 55.

57. An exposure apparatus, comprising:

a substrate attracting and holding system as recited in Claim 41; and

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exposure means for transferring, by exposure, a pattern of an original onto a substrate as attracted and held by said substrate attracting and holding system.

58. A device manufacturing method, characterized by producing a device through manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 57.

59. An exposure apparatus, comprising:

a substrate attracting and holding system as recited in Claim 42; and

exposure means for transferring, by exposure, a pattern of an original onto a substrate as attracted and held by said substrate attracting and holding system.

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60. A device manufacturing method, characterized by producing a device through manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 59.

61. An exposure apparatus, comprising:

a holding table for holding a substrate;

a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

exposure means for transferring, by exposure, a pattern of an original onto the substrate as attracted and held by said holding table,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed above the protrusion.

62. An exposure apparatus, comprising:

a holding table for holding a substrate;

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a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

exposure means for transferring, by exposure, a pattern of an original onto the substrate as attracted and held by said holding table,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed at a central position in relation to disposition of the protrusion.

63. An exposure apparatus, comprising:

a holding table for holding a substrate;

a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the

surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

exposure means for transferring, by exposure, a pattern of an original onto the substrate as attracted and held by said holding table,

wherein the protrusion is provided so that the protrusion is placed at the same position with reference to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

64. An exposure apparatus, comprising:

a holding table for holding a substrate;

a protrusion provided on said holding table, said protrusion being disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced; and

exposure means for transferring, by exposure, a pattern of an original onto the substrate as attracted and held by said holding table,

wherein at least a portion of the protrusion is disposed to surround a zone corresponding to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

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65. A device manufacturing method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced;

reducing pressure between the holding table and the substrate to attract and hold the substrate; and

printing a pattern of an original on the substrate as attracted and held by the holding table,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed above the protrusion.

66. A device manufacturing method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced;

reducing pressure between the holding table and the substrate to attract and hold the substrate; and

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printing a pattern of an original on the substrate as attracted by the holding table,

wherein the protrusion is disposed so that the position of the alignment mark or the position with respect to which the alignment mark is to be produced is placed at a central portion in relation to disposition of the protrusion.

67. A device manufacturing method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, and (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced;

reducing pressure between the holding table and the substrate to attract and hold the substrate; and

printing a pattern of an original on the substrate as attracted by the holding table,

wherein the protrusion is provided so that the protrusion is placed at the same position with reference to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

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68. A device manufacturing method, comprising the steps of:

supporting a substrate by use of a protrusion provided on a holding table for holding the substrate, wherein the protrusion is disposed to be placed in a predetermined positional relationship, with respect to a direction along the surface of the substrate, with (i) a position of an alignment mark to be used for processing the substrate or (ii) a position with respect to which an alignment mark is to be produced;

reducing pressure between the holding table and the substrate to attract and hold the substrate; and

printing a pattern of an original on the substrate as attracted by the holding table,

wherein at least a portion of the protrusion is disposed to surround a zone corresponding to the position of the alignment mark or the position with respect to which the alignment mark is to be produced.

69. A conveying system, comprising:

a cassette for accommodating therein a plurality of chucks being different with respect to disposition of protrusions for supporting a substrate;

a conveyance robot for conveying an arbitrary chuck, selected out of said plurality of chucks accommodated in said cassette, on the basis of information related to a processing region on the substrate; and

a stage for holding the arbitrary chuck conveyed by said conveyance robot and for supporting the substrate with use of protrusions provided on the arbitrary chuck.

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70. A conveying system according to Claim 69, wherein the information related to the processing region includes positional information of an alignment mark.

71. An exposure apparatus, comprising:
a conveying system as recited in Claim 69; and
exposure means for transferring, by exposure, a pattern of an original onto the substrate as supported with protrusion of an arbitrary chuck selected and conveyed.

72. A device manufacturing method, characterized by producing a device through manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 71.

73. A substrate holding system, comprising:
a holding table for holding a substrate;
a protrusion provided on said holding table, said protrusion having a constant relative position with respect to a plurality of alignment marks formed on the substrate or to a plurality of alignment marks to be produced on the substrate.

74. A substrate holding system, according to Claim 73, wherein, at positions on the substrate where the plurality of alignment marks are formed or positions on the substrate where the plurality of alignment marks are to be produced, the substrate has a constant tilt.

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75. An exposure apparatus, comprising:

a substrate holding system as recited in Claim 73; and

exposure means for transferring, by exposure, a pattern of an original onto the substrate as held by said substrate holding system.

76. A device manufacturing method, characterized by producing a device through

manufacturing processes including a process for exposing a substrate by use of an exposure apparatus as recited in Claim 75.

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